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Revision of the genus *Chiasognathus* Stephens of southern South America with the description of a new species (Coleoptera, Lucanidae, Lucaninae, Chiasognathini)

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Abstract

The genus *Chiasognathus* Stephens is revised and now consists of seven species, all of which are endemic to southern South America. The genus-level names *Bomansodus* Chalumeau & Brochier, *Carmeniella* Molino-Olmedo, and *Ramireziella* Molino-Olmedo are all confirmed to be synonyms of *Chiasognathus*. A new species of *Chiasognathus* is described from the Biobío Region of Chile. The species *Chiasognathus mniszechii* Thomson is removed from synonymy and is a valid species with *Chiasognathus schoenemanni* Kriesche as its junior synonym. In order to promote nomenclatural stability, a lectotype is designated for the name *Chiasognathus reichei* Thomson, and a neotype is designated for the name *Chiasognathus pygmaeus* Dallas.

Keywords

Systematics, Lucanidae, Chile, Argentina, Scarabaeoidea, stag beetle

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Introduction

The genus *Chiasognathus* Stephens (Lucanidae: Lucaninae: Chiasognathini) is distributed in southern South America in Chile with some species extending into Argentina. The latest taxonomic treatment of Chiasognathini was done by Chalumeau and Brochier (1995, 2007), who listed four species in the genus *Chiasognathus* and one in the genus *Bomansodus* Chalumeau & Brochier. Molino-Olmedo (2001, 2002, 2003, 2006) also published a series of recent papers on the phylogeny and classification of *Chiasognathus*. In spite of the large size and distinct appearance of these beetles, some species are difficult to identify because they exhibit considerable intraspecific variation. As a result, the scientific literature on *Chiasognathus* is checkered with misidentifications and misinterpretations of species. Although the genus was treated recently, Chalumeau and Brochier (2007) correctly identified only three of the seven species known to us, thus necessitating this revision.

Catalogs have gone from one extreme to the other, with Benesh (1960) recognizing only three species of *Chiasognathus,* while Maes (1992) listed six valid species. Some species names have a history of repeatedly being synonymized and revalidated by various authors. We refer the reader to Numhauser (1981) for such details and will focus primarily in this paper on the synonymies recognized within the past three decades.

The genus *Chiasognathus* forms part of the tribe Chiasognathini, which is distributed in South America and Australia. Smith (2006) considered Chiasognathini a synonym of the subfamily Lucaninae Latreille because of the chaotic state of lucanid classification, especially within the subfamily Lucaninae. However, we reverse this synonymy based on the almost universal recognition of this taxon in the lucanid literature. Chiasognathini was firmly placed in the subfamily Lucaninae by the morphological characters discussed by Holloway (1960, 1968, 1997, 2007) and is treated as such in the most recent lucanid catalogs and checklists (Krajcik 2001; Paulsen 2008). Maes (1992) and Chalumeau and Brochier (2007) both treated Chiasognathini as a subfamily without justification or differentiation from the subfamily Lucaninae.

Chiasognathus grantii Stephens was the first species described in the genus. The males of this species are spectacular (see Figs 1–2), making them one of the most often illustrated lucanids in popular books and websites on insects. This species is highly distinctive, and there is no doubt about its identification, even with the crude drawings of Stephens (1831) in the original description or of the considerably better drawings by Lesson (1833) of *Tetropthalma chiloensis* Lesson (a junior synonym of *C. grantii*).

Through the mid to late 1800s and early 1900s, there was a proliferation of *Chiasognathus* species described. Reiche (1850a, b) described *C. jousselinii*, Solier (1851) described *C. latreillei*, and Parry (1870) described *C. impubis* — three species that we consider valid. Several species were also described that were later placed in synonymy with *C. grantii* or *C. latreillei*, namely: *C. affinis* Philippi and *C. pygmaeus* Dallas (synonyms of *C. grantii*), and *C. imberbis* Philippi and *C. reichei* Thomson (synonyms of *C. latreillei*) (see Philippi 1859; Thomson 1862; Dallas 1933). Thomson (1862) also described *C. mniszechii*, a species that was later synonymized with *C. jousselinii* but is

Figures 1–2. 1 Threat display of male *Chiasognathus grantii* **2** Mate guarding posture in *C. grantii,* adopted here at a light trap.

here removed from synonymy and considered a distinct species based on the examination of the type specimens. *Chiasognathus schoenemanni* Kriesche was described from an abraded specimen (Kriesche 1919) and subsequently treated as a synonym of *C. jousselinii* by Krajcik (2001) and Chalumeau and Brochier (2007), but it is actually a synonym of *C. mniszechii*.

Only a single species of *Chiasognathus* has been described during the past 75 years: *Chiasognathus beneshi* Lacroix (Lacroix 1979), a species that is similar to *C. latreillei*. The immense popularity of this genus makes it surprising that one additional species remained undescribed due to the confusion over synonymies in the genus, and in this paper we remedy that situation with the description of that species as new.

Over the past 15 years, authors have attempted to split *Chiasognathus* into multiple genera/subgenera. Chalumeau and Brochier (1995) described *Bomansodus* for the single species *C. impubis*. Molino-Olmedo (2001) later attempted to erect two new subgenera within *Chiasognathus*: *Carmenia* Molino-Olmedo (for *C. latreillei*) and *Ramirezia* Molino-Olmedo (for *C. jousselinii*, *C. mniszechii*, and *C. schoenemanni*). Unfortunately, Molino-Olmedo (2001) neglected to explicitly designate type species for his two new subgenera, and so *Ramirezia* is unavailable from this publication (although *Carmenia* is available from this publication because the type species was automatically fixed by monotypy). Molino-Olmedo (2002) later published another paper describing the same two subgenera and this time designated type species and properly validated the name *Ramirezia*. Therefore, *Carmenia* Molino-Olmedo was made available from the 2001 publication and *Ramirezia* Molino-Olmedo was made available from the 2002 publication. It is unclear why the author published two very similar papers almost simultaneously in different journals with descriptions of the same new taxa in both papers. In another unfortunate twist, Molino-Olmedo (2003) realized too late that both *Carmenia* and *Ramirezia* were permanently invalid names because both are junior homonyms. He proposed *Carmeniella* and *Ramireziella*, respectively,

as replacement names (Molino-Olmedo 2003). The two sets of authors who recently erected new genus-group names for *Chiasognathus* species did not agree with each other. Molino-Olmedo (2006) synonymized *Bomansodus* with *Chiasognathus*. Subsequently, Chalumeau and Brochier (2007) resurrected *Bomansodus* and synonymized *Carmeniella* Molino-Olmedo and *Ramireziella* Molino-Olmedo with *Chiasognathus*. We here consider all of the above genus-level names to be synonyms of *Chiasognathus* for reasons discussed below.

Despite being treated numerous times, our examination of the type specimens indicated that the identities of some species are confused, even though Chalumeau and Brochier (2007) reported to have also examined type material. The main goal of this paper is to alleviate confusion about the species and circumscription of *Chiasognathus* by redefining the genus and each of the included species. As mentioned above, the confusion surrounding the nomenclature of *Chiasognathus* left one species without a formal description, which is rectified in this paper.

The study of the genus has historically been hampered by a few factors, and these were examined in marvelous detail by Numhauser (1981). In addition, our previous revisions of the fauna of this region have taught us that an unusually large number of locality labels from Chile are erroneous. For some taxa in this study, this is a major impediment to determining correct distributions. There are already few specimens available of the more difficult taxa, making the problem of erroneous data even more of an issue. Also, specimens of the variable *C. latreillei* are available for study only from a handful of widely separated localities. Because of this, we are tentative about our hypothesis concerning this taxon. It is possible that the availability of larger series and specimens from additional localities will make clear if this taxon is one species or a complex of more than one cryptic species.

Chiasognathus larvae have been described and discussed in a few papers. Cekalovic and Castro (1983) first described the larvae of *C. grantii* based on 16 specimens from various localities. Onore (1994) listed diagnostic characters for Chiasognathini larvae including *Chiasognathus*. Molino-Olmedo (2005) recently provided an additional description purportedly of *C. latreillei*.

Materials and methods

Specimens and Taxonomic Material. Specimens examined for this study were provided by the following institutions and private collections. A total of 445 specimens, including all accessible type material, formed the basis of this research. Acronyms for institutions when available are from Evenhuis (2009).

ABTS Andrew B. T. Smith Collection, Ottawa, Canada
AMNH American Museum of Natural History, New York, NY, USA (Lee Herman)
AUPC Alfredo Ugarte Peña Collection, Santiago, Chile
BMNH The Natural History Museum, London, UK (Max Barclay)

CASC California Academy of Sciences, San Francisco, CA, USA (Jere Schweikert, David Kavanaugh)
CMNC Canadian Museum of Nature, Ottawa, Canada (François Génier)
CNCI Canadian National Collection of Insects, Ottawa, Canada (Patrice Bouchard)
CUMZ Cambridge University Museum of Zoology, Cambridge, UK (William Foster)
EPGC Everardo & Paschoal Grossi Collection, Nova Friburgo, Brazil
FMNH Field Museum of Natural History, Chicago, IL, USA (James Boone)
JMEC José Mondaca E. Collection, Santiago, Chile
LBC Luca Bartolozzi Collection, Florence, Italy
LEMQ Lyman Entomological Museum, McGill University, Ste. Anne de Bellevue, PQ, Canada (Terry Wheeler, Stéphanie Boucher)
MJPC M.J. Paulsen Collection, Lincoln, NE, USA
MNHN Muséum National d'Histoire Naturelle, Paris, France (Stéphane Boucher, Olivier Montreuil, Thierry Deuve)
MNNC Museo Nacional de Historia Natural, Santiago, Chile (Mario Elgueta)
NHRS Swedish Museum of Natural History, Stockholm, Sweden (Bert Viklund)
SMTD Staatliches Museum für Tierkunde, Dresden, Germany (Olaf Jäger)
UNSM University of Nebraska State Museum, Lincoln, NE, USA (M.J. Paulsen)
ZMHB Zoologisches Museum der Humboldt-Universitat, Berlin (Johannes Frisch)

Morphological characters. Conventions used in the description of morphological characters are as in Paulsen (2005). Mandibular development is sexually dimorphic and varies allometrically within males of each species. Major males are larger-bodied males that possess enlarged mandibles that are more elongate, usually with additional internal teeth. Minor males are smaller-bodied males that often have less-developed mandibular teeth. Female mandibles in *Chiasognathus* species are similar to those found in all chiasognathine females, with a flattened dorsal surface and usually one internal tooth. We use the term *nasus* to refer to the projection of the anterior margin of the head when visible in dorsal view, as in Chalumeau and Brochier (2007). The maxilla and labium in *Chiasognathus* species bear elongated setal brushes that may be diagnostic in length; here we are concerned only with the relative length of the longest setae on these structures, which we term the *galeal brush* after Nel and Scholtz (1990).

Characters of the pronotum, elytra, male mandibles, legs, vestiture, and genitalia are useful in diagnosing species of *Chiasognathus*. Chalumeau and Brochier (2007) discounted the usefulness of the male genitalia for species diagnosis, and this is true with respect to the median lobe and parameres that exhibit considerable intraspecific variation. However, a character of the male genitalia that we found to be useful in this genus is the form of the flagellum (the sclerotized, everted internal sac) that is diagnostic in the material studied. The length of the flagellum varies from short (~1 mm) to extremely long (~18mm; Figs 3–9) depending on the species.

Figures 3–9. Male genitalia of *Chiasognathus* species. **3** *C. grantii* **4** *C. impubis* **5** *C. jousselinii* **6** *C. mniszechii* **7** *C. sombrus,* sp. n. **8** *C. beneshi,* and **9** *C. latreillei.* Scale bars = 2mm.

Taxonomic Treatment

Tribe CHIASOGNATHINI Burmeister, 1847

Type genus: *Chiasognathus* Stephens, 1831: 213.

Genus *Chiasognathus* Stephens, 1831

Chiasognathus Stephens, 1831: 213. Type species: *Chiasognathus grantii* Stephens 1831, by monotypy.

Tetropthalma Lesson, 1833: plate 24. Type species *T. chiloensis* Lesson 1833, by monotypy.

Bomansodus Chalumeau & Brochier, 1995: 20. Type species *Chiasognathus impubis* Parry 1870, by original designation. Synonymy reinstated.

Carmenia Molino-Olmedo, 2001: 85. Type species *Chiasognathus latreillei* Solier, 1851 by monotypy. Junior homonym of *Carmenia* Roewer, 1915.

Ramirezia Molino-Olmedo, 2002: 124. Type species *Chiasognathus jousellinii* Reiche, 1850 by original designation. Junior homonym of *Ramirezia* Zamponi, 1979. Mo-

lino-Olmedo (2001: 85) attempted to describe this generic name earlier but did not designate a type species, and so the name is not available from the 2001 publication.

Carmeniella Molino-Olmedo, 2003: 29. Type species *Chiasognathus latreillei* Solier, 1851 by monotypy. Replacement name for *Carmenia* Molino-Olmedo 2001.

Ramireziella Molino-Olmedo, 2003: 29. Type species *Chiasognathus jousellinii* Reiche, 1850 by original designation. Replacement name for *Ramirezia* Molino-Olmedo, 2002.

Description. ***Length*:** 16.6–88.0 mm. ***Width*:** 8.4–17.0 mm. ***Color*:** Light to dark reddish brown, commonly with green to purple metallic reflections. ***Head*:** Form subquadrate to subtriangular, narrower than 1 elytron width, shorter than mandibles in both sexes. Disc surface uneven, often with foveae or apparent tubercles. Surface punctate; punctures fine to coarse, generally setose with short to long setae. Ocular canthus well developed, externally rounded, dividing eye completely into upper and lower portions. Temporal process absent. Anterior angles produced, obtuse or acute. Anterior margin of head in dorsal view varying from weakly emarginate to strongly produced into binodose or acute nasus (nasus when present occasionally migrated anteroventrally and obscured in dorsal view); head below anterior margin and nasus declivous and recessed forming more or less vertical intermandibular projection. Labrum scoop-like, lightly sclerotized, vertical, separated from intermandibular projection by a distinct suture; apex of labrum rounded or acute. Male mandibles 2–6× as long as head, right mandible usually shorter than left, both mandibles with a single, dentate carina (more or less cylindrical, lacking well-defined external or internal carinae present in *Sphaenognathus* Buquet); dentate carina generally dorsal at base becoming more internal toward apex. Apex abruptly curved, acute. Mandibular surface punctate; punctures generally setose, setae sparse to dense. Female mandible externally weakly rounded to almost straight in dorsal view, never with external tooth; dorsal surface flattened, internally subdentate (acute tooth occasionally present near middle), punctate; punctures setose with short to long setae. Maxilla and labium with long or short galeal brushes, palps elongate. Mentum transverse, subtrapezoidal, anteriorly emarginate, punctate; punctures fine to coarse, pubescent. Antennal club composed of 6 entirely tomentose antennomeres; antennomeres gradually increasing in length distally. Funicle not tomentose, instead pubescent with scattered setae; distal antennomere of funicle produced as in club or not. Scape elongate, longer than funicle and club together, normally with long setae present at enlarged apex. ***Pronotum*:** Shape subtrapezoidal, broadest in basal fifth, anteriorly convergent with rounded sides (margin not strongly produced near anterior angles). Anterior margin sinuate. Anterior angles not prominent. Posterior angle and lateral angle variably developed: obsolete, subdentate, to strongly dentate. Lateral margins distinct and crenulate, rarely obsolete anterolaterally. Dorsal surface generally with variably developed longitudinal and transverse ridges surrounding longitudinal, median furrow; when present ridges less punctate than disc; punctures fine to moderate, variably dense, setose; setae short to long. Each side with subcircular fovea; fovea generally impunctate and glabrous. ***Scutellum*:** Form broad, rounded. Surface densely to sparsely punctate; punctures setose or not. ***Elytra*:** Form broad and short, convex. Surface gener-

ally smooth, occasionally weakly wrinkled, punctate; punctures fine and extremely dense (distance between punctures ≤1 puncture diameter), setose; setae scale-like, microscopic to clearly visible. Humeri broadly rounded. Apex broadly rounded, angulate, or dentate. Epipleuron strongly concave or flat. ***Wings*:** Fully developed. ***Legs*:** Protibiae dentate or serrate externally from base to 2 larger, apical teeth; ventral surface along internal margin with series of downward-pointing teeth. Mesotibiae and metatibiae with 4–6 external teeth, teeth of metatibiae less distinct, occasionally absent. Onychium of claws with more than 4 setae. ***Venter*:** Ventral surface densely pubescent, especially mesosternum. Last abdominal segment distinctly emarginate in males. ***Male genitalia*:** Genital capsule simple and parameres of generalized lucanid form. Median lobe strongly sclerotized, form cylindrical or widening apically, with everted internal sac forming flagellum; flagellum simple, length varying from <1 mm to 18 mm (Figs 3–9).

Distribution. *Chiasognathus* species are distributed in Regions VII-XI and XIV of Chile and in adjacent parts of Argentina.

Diagnosis. In the New World lucanine fauna, *Chiasognathus* species are immediately recognizable as members of the tribe Chiasognathini because their antennal club is composed of six antennomeres; they are the only stag beetles in southern South America to display this character.

Remarks. The following characters were used by Moxey (1962) to distinguish *Chiasognathus* from the only other genus of South American Chiasognathini, *Sphaenognathus* (including the subgenus *Chiasognathinus* Didier): front of head projected (nasus) and usually acute, antennal scape 1.5–3.0 times longer than funicle and club combined, and elytral surface not strongly sculptured. Molino-Olmedo (2001) rightfully questioned each of these characters given the variability of the nasus and elytral sculpture and lack of a demonstrable difference in antennal scape length. However, we feel the recognition of these genera as distinct is warranted, and this is especially true with respect to the biogeography of South America, as all known southern South American lucanids are distinct from their Neotropical relatives at the generic level (Paulsen and Mondaca 2006; Grossi and Paulsen 2009).

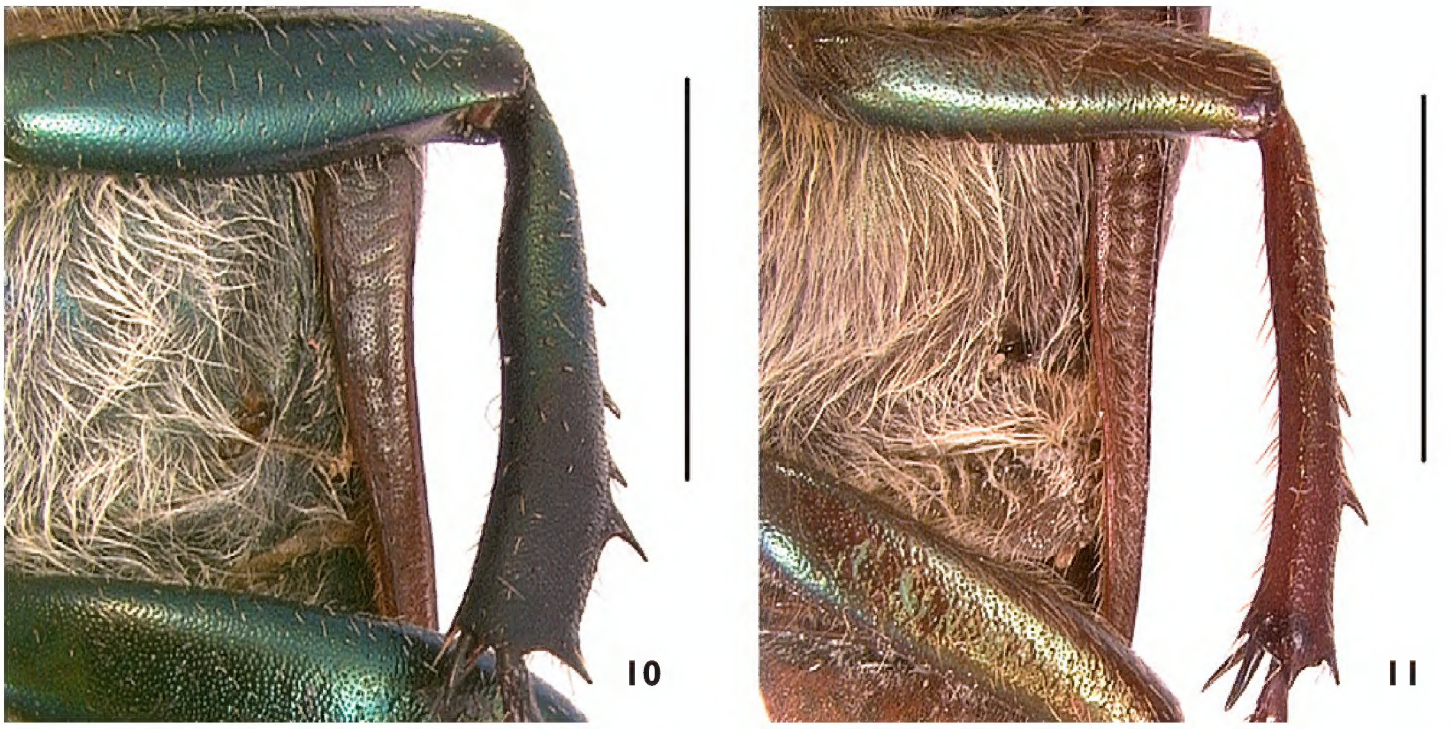
There are few reliably expressed characters that can be used to distinguish *Chiasognathus* and *Sphaenognathus,* and these unfortunately tend to be observable in only one sex or the other. Male mandibles in *Chiasognathus* species are rounded externally, not carinate, and therefore appear to be more cylindrical than the mandibles of males of *Sphaenognathus* species, which are often more triangular in cross section. Importantly, the teeth on *Chiasognathus* male mandibles are located where the usually toothless (rarely with a single large tooth basally) dorsal carina is found in *Sphaenognathus* species; the teeth on *Sphaenognathus* male mandibles are on an internal ventral carina that is not present in *Chiasognathus* species. Female mandibles are weakly rounded externally in *Chiasognathus* species, never with an external tooth as in females of some *Sphaenognathus* species. Male abdominal apices are strongly emarginate in *Chiasognathus* species but more or less straight or rarely weakly emarginate in *Sphaenognathus* species. Finally the lateral margin of the pronotum is produced near the anterior angles in females of *Sphaenognathus* species but is more convergent towards the head in *Chiasognathus* species females.

Chalumeau and Brochier (2007) emphasized three characters used to differentiate *Bomansodus* in their earlier work (Chalumeau and Brochier 1995): male mandibular structure, nasus/intermandibular projection, and effaced lateral pronotal margin. We can find no clear discussion of how the mandibular structure of *C. impubis* differs from its congeners in either work, and our examination of the mandibles indicates that they are of the same basic plan as those of the remaining *Chiasognathus* species. Only *C. grantii* and *C. mniszechii* more or less consistently possess a prominent nasus; therefore, its absence cannot be used to segregate *C. impubis* from the genus as a whole. Finally, some specimens of *C. impubis* we have studied do have a distinct lateral pronotal margin. While it is true that the pronotum is overall more rounded and less distinctly ridged in *C. impubis*, the character is too weak and variable to support a generic distinction. This is especially true with respect to the shared characters of *C. impubis* and *C. mniszechii,* namely the strikingly concave epipleuron, similar protibiae, and beaded elytral margin. For these reasons, we reconfirm the synonymy of *Bomansodus* with *Chiasognathus.*

Molino-Olmedo (2001, 2006) accepted (but later rejected) *Bomansodus* and created additional subgenera with the result of placing almost all species in their own genus or subgenus. There is little justification for such over-splitting of a small, clearly related group based on what amount to species-level characters. We agree with the arguments presented by Chalumeau and Brochier (2007) against the validity of the Molino-Olmedo subgenera. Our greatest concern is that the work was premature given that it was not preceded by a careful revision of the group and was, therefore, founded on an incomplete understanding of the taxonomy of the genus. Thus, we include the seven species in a single genus and are confident that our taxonomic treatment of the species will provide a foundation for future research into the relationships and evolution of *Chiasognathus.*

Key to Adults of *Chiasognathus* Species

1. Apex of elytra spinose. Males with large tooth projecting ventrally from each mandible, females with ridge or large tubercle in the same spot ... ***C. grantii* Stephens**
– Apex of elytra not spinose, either subdentate or rounded. Males and females at most with small ventral tooth at base of mandible..... **2**
2. Epipleuron strongly concave in basal third of elytra. Elytral apex with beaded margins to just before apex..... **3**
– Epipleuron more or less flat in basal third of elytra. Elytral apex thickened, with margin lacking bead..... **4**
3. Prothorax with lateral margin obsolete anteriorly. Elytra distinctly shiny; surface glabrous in males, with long scattered bristles in females..... ***C. impubis* Parry**
– Prothorax with lateral margin strongly indicated throughout, crenulate. Elytra usually densely squamose (rarely abraded).... ***C. mniszechii* Thomson**
4. Dorsal surface entirely squamose with short scales..... ***C. jousselinii* Reiche**
– Dorsal surface (especially pronotum) more or less glabrous..... **5**
5. Mesotibia thickened (Fig. 10). Specimens known only from Ñuble Province (VIII Región del Biobío, Chile) ..... ***C. sombrus* Paulsen & Smith, sp. n.**
– Mesotibia not thickened (Fig. 11). Specimens from farther south..... **6**



Figures 10–11. 10 Robust right mesotibia of *C. sombrus,* ventral view. **11.** Slender right mesotibia of *C. latreillei,* ventral view. Scale bars = 5 mm.

6. Males with median mandibular teeth directed internally, apex usually simply acute. Flagellum of male genitalia extremely short (Fig. 9). Specimens from Biobío to Los Lagos (VIII-X Regiones) in Chile and Neuquén to Chubut in Argentina..... ***C. latreillei* Solier**

– Males with median mandibular teeth directed dorsally, apex surrounded by additional dorsal and ventral teeth. Flagellum of male genitalia moderately long (Fig. 8). Specimens from Aisén (XI Región, Chile)..... ***C. beneshi* Lacroix**

Chiasognathus beneshi Lacroix, 1978

Figs 8, 12, 27

Chiasognathus beneshi Lacroix, 1978: 250. Type material: Holotype reportedly deposited in the J. P. Lacroix collection. Lacroix is deceased, and the Lacroix collection is not available for study and is in an unknown state of preservation. Type locality: "Chili, Province d'Aysen: Río Manihuales".

Description. ***Length*:** 21.7–28.0 mm. ***Width*:** 10.0–12.6 mm. ***Color*:** Reddish brown with weak green or purple metallic reflections. ***Head*:** Form subquadrate. Surface punctate; punctures fine to coarse, generally setose with short to long setae. Anterior margin of head rounded or concave, not strongly produced beyond anterior angles, lacking median nasus. Anterior angles obtusely rounded in dorsal view. Male mandibles cylindrical, 1.5–2× as long as head, externally almost straight until internally curved apex. Dentate carina beginning with basal tooth on dorsal surface, continuing along internal edge, not becoming internal; dorsal and ventral teeth present either side of apex resulting in scoop-like appearance; apex lacking

patch of setae. Base of mandibles lacking ventral tooth. Female mandible externally rounded in basal third, dorsally flattened, with median internal tooth. Galeal brush moderately long, 2× longer than mentum. Antennal scape with sparse area of long setae present in males, or setae absent. ***Pronotum*:** Posterior and lateral angles dentate, posterior angle more strongly so in males, or angles obsolete. Lateral margins distinct, crenulate. Dorsal surface with transverse ridge, longitudinal median furrow broad, weak depressions indicated either side of disc before middle in most specimens. Surface near margins with distinct, moderately long setae in females, glabrous in males examined. ***Elytra*:** Surface weakly shiny, appearing wrinkled, densely punctate, setose; setae scale-like, often abraded except on lateral elytral declivity; females lacking distinct, scattered, longer bristle-like setae. Apex rounded, lacking spine. Epipleuron flat. ***Legs*:** Protibiae short, serrate externally; ventral surface along internal margin with 2–5 small teeth. ***Male genitalia*:** Flagellum moderately long, subequal in length to basal piece (Fig. 8).

Distribution. Specimens were examined only from Aisén, Chile (Fig. 27).

CHILE (6): **Aisén** (6): Caleta Tortel, Coihaique, Lago Yulton, Río Correntoso.

Temporal distribution. January (3), February (3).

Diagnosis. This species, although externally nondescript (Fig. 12), can be separated from the *C. latreillei* complex by the longer flagellum of the male genitalia and by its geographic distribution.

Remarks. The amateur entomologist J. P. Lacroix described this species. Most taxa named by Lacroix, especially in the Chiasognathini, are now considered synonyms, including eight of twelve available Lacroix names in *Sphaenognathus* (Chalumeau and Brochier 2007; Paulsen 2008). The type specimen was not deposited in an institution and is unavailable for study, but we have examined specimens from near the type locality in Aisén that display mandibles identical to those drawn for the holotype of *C. beneshi*. These specimens have a distinctly longer flagellum of the male genitalia than do *C. latreillei.* Because this character appears to be useful in separating other species in the genus, we have refrained from synonymizing *C. beneshi* at this time. However, externally there are few strong morphological characters to support the distinction, in part because the *C. latreillei* complex is so variable and possibly composed of multiple taxa. The median teeth of the male mandibles in *C. latreillei* generally point distinctly inward, while in the *C. beneshi* material studied the teeth remain more or less vertical. The apex of the male mandible in *C. beneshi* generally has a strong tooth above and below the apex, giving a scoop-like appearance, and the mandibles overall are more cylindrical and curved internally at the apex. Most specimens of *C. latreillei* have externally straighter mandibles with a simple apex. Unfortunately, a few specimens of the *C. latreillei* complex have mandibles similar to those of *C. beneshi*. The specimens treated as *C. beneshi* by some authors (Mizunuma and Nagai 2001; Chalumeau and Brochier 2007) represent an undescribed species that we describe below. *Chiasognathus beneshi* was previously recorded from Biobío (Las Trancas) but this locality is erroneous due to the misapplication of the name – this species is only known to occur in Aisén region of Chile.

Figures 12–13. Dorsal habitus of *Chiasognathus* species, males. **12** *C. beneshi,* and **13** *C. latreillei.*

Chiasognathus grantii Stephens, 1831

Figs 1–3, 14–15, 28

Chiasognathus grantii Stephens, 1831: 214. Type material: holotype male (CUMZ) labeled a) red label "*Chiasognathus* / *grantii Stephens, 1831* / HOLOTYPE [male symbol] / Det: M.J. Paulsen & A.B.T. Smith". Type locality: "Island of Chiloe."

Tetropthalma chiloensis Lesson, 1833: plate 24. Type material: lectotype designated by Chalumeau and Brochier (2007) using the original illustration in Lesson (1833) under ICZN Article 74.4. The original specimen could not be located in the MNHN and has presumably been lost. Type locality: "l'île de Chiloë."

Chiasognathus affinis R. Philippi in F. Philippi, 1859: 658. Type material: Lectotype male (MNNC) designated by Chalumeau and Brochier (1995) labeled a) hand-written "*Chiasognathus* / *affinis* Phil."; b) orange label "LECTOTYPE"; c) hand-written "*Chiasognathus* / *affinis* Phil. / det F. Chalumeau / & B. Brochier '94"; d) *Chiasognathus grantii* / Stephens / Dét. det F. Chalumeau / & B. Brochier '94"; e) red label "*Chiasognathus* / *affinis* / Philippi [male symbol] / LECTOTYPE / A.B.T.

Smith"; f) "*Chiasognathus* / *grantii* / Stephens, 1831 / det. M.J. Paulsen 2010". Type locality: "cerca del Corral."

Chiasognathus pygmaeus Dallas, 1933: 74. Type material: Holotype lost – reportedly deposited in the Dallas collection (Dallas 1933). Primary types should be deposited in legitimate institutional collections so they have a good chance of being available for study by taxonomists. Neotype male, (MNNC) HERE DESIGNATED, labeled a) handwritten "Aysen / I-37"; b) "['95] / *Chiasognathus grantii* / Stephens / Dét. Chalumeau & B. Brochier / [var. *pygmaea*]"; c) red label "*Chiasognathus* / *pygmaeus* Dallas male symbol / NEOTYPE / Paulsen & Smith" ; d) "*Chiasognathus* / *grantii* / Stephens, 1831 / det. M.J. Paulsen 2010". A neotype is designated in order to preserve the stability of nomenclature by selecting one specimen as the sole, name-bearing type of this taxon because the original name-bearing type specimen(s) was lost or destroyed. The neotype specimen serves to tie the published name to an actual specimen and as a reference standard for the taxon. This is important because there has been confusion in the literature regarding this name with disagreement whether it is a valid species, synonym of *C. grantii*, or synonym of *C. latreillei*. Type locality: "Chile".

Description. ***Length*:** 24.5–88.0 mm. ***Width*:** 9.5–17.0 mm. ***Color*:** Light to dark reddish brown, everywhere with green, gold, or purple metallic reflections. Pronotum with metallic coloration gold/green on disk, becoming purple near margins, lateral fovea darker bluish-green. Elytra with disc greenish-brown due to weak green and purple metallic reflections, lateral margin darker metallic green. ***Head*:** Form subquadrate in minor males and females, subtriangular in major males. Surface punctate; punctures fine to coarse, generally setose with short to long setae. Anterior margin of head produced beyond anterior angles and always with median nasus, nasus variably binodose or simply obtuse. Anterior angles produced ventrally, acute in dorsal view. Male mandibles 2–6× as long as head, externally sinuate, arched and somewhat flattened in lateral view; dentate carina internally on dorsal margin for entire length of mandible; teeth variable along mandible, large basal tooth followed by serrate margin in basal third and more widely spaced, peg-like teeth in apical two-thirds. Apex abruptly curved, distally acute and hooked upwards in male majors, male majors with patch of setae inside apex. Base of mandibles with large, ventral tooth always present, in male majors longer than head; tooth internally serrate. Female mandible externally rounded, never with median internal tooth, but with strongly produced internal carina ventrally near base. Galeal brush elongate, 2–3× longer than mentum. Antennal scape with well-developed area of long setae present at apex in males. ***Pronotum*:** Posterior angle and lateral angle strongly dentate, especially in males; posterior angle uncinate and somewhat curved anteriorly in major males. Lateral margins distinct, weakly crenulate. Dorsal surface not strongly ridged, longitudinal median furrow distinct basally. ***Elytra*:** Surface shiny, appearing smooth, actually densely punctate, setose; setae scale-like, microscopic, often broken off. Apex spinose with acute spine. Epipleuron flat. ***Legs*:** Protibiae elongate, dentate externally; ventral surface along internal margin with teeth well developed.

Figures 14–15. Dorsal habitus of *C. grantii.* **14** male, and **15** female.

***Male genitalia*:** Flagellum long, length more than 2× length of parameres and basal piece together (Fig. 3).

Distribution. This species is found in central Chile and neighboring areas of Argentina (Fig. 28).

ARGENTINA (38): **Chubut** (9): Lago Puelo, Parque Nacional Los Alerces; **Neuquén** (26): Parque Nacional Lanín, Pucará, San Martín de los Andes; **Río Negro** (3): El Bolsón, Lago Guillelmo.

CHILE (123): **Biobío** (5): La Invernada, Ñuble, Las Trancas; **La Araucanía** (11): Cherquenco, Curacautín, Parque Nacional Huerquehue, Malleco, Villarrica; **Los Ríos** (9): Monumento Nacional Alerce Costero, Llifen, Valdivia; **Los Lagos** (36): Ahoni, "Chiloe", Dalcahue, Lago Chapo, Llanquihue, Palena, Puerto Varas, Parque Nacional Puyehue; **Aisén** (62): Aisén, Coihaique. **No data** (6).

Temporal distribution. January (32), February (119), March (7), June (1), November (4), December (5).

Diagnosis. This species is the most readily identifiable in the genus (Figs 14–15). The large ventral tooth on the mandibles of males, smooth and apparently glabrous

elytra, and spinose elytral apex in both sexes are diagnostic. Male majors, with their extremely elongate mandibles and large size, cannot be confused with any other species.

Remarks. Stephens (1831) described *C. grantii* based on a single holotype specimen. This specimen was found in the University of Cambridge Museum of Zoology, U.K. The holotype was likely part of the Stephens collection that was acquired by the Cambridge Philosophical Society. The entire insect collection of the Cambridge Philosophical Society was turned over to the University of Cambridge in 1865 as the foundation of a museum collection at the university. Unfortunately, none of the Stephens specimens were properly labeled so we had to match the attributes of this particular specimen to the original illustrations of Stephens (1831) to verify that it is the holotype. The male mandibles of this species can display great variation in their length, thickness, and curvature, and this specimen perfectly matches the specific curving and unusually large and thick mandibles of the original illustration. Specimens of such great size are relatively rare, and the general way the specimen is mounted also closely matches the original illustrations. The fact that this specimen was the only *C. grantii* specimen found in the University of Cambridge Museum of Zoology (the subsequent depository of Stephens' collection) and that it matches the original description and illustrations gives us enough evidence to state that this specimen is the holotype. Stephens (1831) reported that a Chilean collected this specimen in January on Chiloé Island and gave it to Dr. Grant, who was the surgeon on board the H.M.S. Forte.

The immense variation in size in this species has prompted the continued use of the name '*pygmaeus*' for the smaller males despite any evidence that would suggest distinct populations or genetic uniqueness. The idea remains tempting to amateur collectors, possibly because even these smaller males are of a similar size (and show the same amount of allometric development) as male majors of other species such as *C. mniszechii*. The development of male majors in *C. grantii* that are twice-again as large, and how this relates to the breeding behavior of the species, is something that deserves to be studied in more detail.

Benesh (1960), and thus Krajcik (2001), listed *C. pygmaeus* under synonymy with *C. latreillei* despite the photograph in the original that clearly depicts a small *C. grantii.* Nevertheless, this demonstrates the existence of some confusion about the taxon and that the designation of a neotype is warranted.

Natural History. Grant's stag beetle, sometimes referred to as Darwin's stag beetle, is the largest species in the genus and one that commands a great deal of attention. Other common names for the species include ciervo volante, llico-llico, and cantábria. The species was observed by Darwin in Chile (Darwin 1871): "The male *Chiasognathus grantii* of South Chili – a splendid beetle … has enormously-developed mandibles; he is bold and pugnacious; when threatened on any side he faces round, opening his great jaws, and at the same time stridulating loudly; but the mandibles were not strong enough to pinch my finger so as to cause actual pain." Darwin's observations were expanded by Joseph (1928) and Hamilton (2000) with further discussion on the behavior of *C. grantii* males. To this we add our own observations made while collecting in Chile. Males of *C. grantii* are energetic and will attempt to pinch with their elongate mandibles when handled. As

noted by Arrow (1951), the bite of a female would be much more painful, although the sharp mandibular apex of males can draw blood (ABTS, personal observation). Males will raise up on their middle and hind legs when threatened or when approached by another male (Fig. 1). When another male is introduced, the two individuals will move together and adopt this aggressive posture and will then battle each other. Each will attempt to grip with their mandibles around the lateral teeth of the pronotum of their opponent. Once a strong grip is established there is an attempt to lift the opponent and drop it to the ground. When a female is introduced, the successful combatant will adopt an apparent mate-guarding stance with his mandibles and legs arched over the female (Fig. 2) and will battle any other males that approach. Hamilton (2000) reported that male combat occurs either in trees, where the females feed on sap, or among the flowers of the native canelilla, a climbing hydrangea (*Hydrangea serratifolia* (H. et A.) F. Phil (Hydrangeaceae)). Adults have been reported to feed on the sap of *Nothofagus betuloides* (Mirbel) Oersted, *N. nitida* (Phil.) Krassen, *N. obliqua* (Mirbel) Oersted (Fagaceae), and *Weinmannia trichosperma* Cav. (Cunoniaceae) (Joseph 1928; Vergara and Jerez 2009). As with other chiasognathines, larvae live in the soil (Joseph 1928). Adults may be seen flying just before dark and are attracted to light.

Arrow (1904) discussed the stridulatory mechanism present in adults of both sexes of *C. grantii,* and that it is composed of a ridged elytral margin and corresponding grooves on the hind femora. These modifications are not present in the other species in the genus, thus sound production in the adult appears to be an autapomorphy of this species that may be related to the larger size and threat display behavior.

Chiasognathus impubis Parry, 1870

Figs 4, 16–17, 29

Chiasognathus impubis Parry, 1870: 68, original combination. Type material: Lectotype male (BMNH) designated by Chalumeau and Brochier (1995) labeled a) circular label "Mendoza"; b) handwritten on blue-gray paper "*C. impubis* Ph."; c) red circled label "Type"; d) bordered label "*Bomansodus impubis* ['93] / (Parry) / Det. F. Chalumeau & B. Brochier." Paralectotype male (MNHN) labeled a) "*impubis* Parry, Chili / [ex. Musaeo E.D. Brown] / [ex. R. Oberthür]. Type locality: "Chili… Mendoza, on the eastern side of the Cordillera."

Description. ***Length*:** 24.5–34.5 mm. ***Width*:** 11.5–14.9 mm. ***Color*:** Reddish brown, everywhere with weak green or purple metallic reflections. Pronotum, head, and scutellum with stronger reflections. ***Head*:** Form subquadrate. Surface punctate; punctures fine to coarse, generally setose with short to long setae. Anterior margin of head sinuate, not strongly produced beyond anterior angles, lacking median nasus (anterior margin at middle rarely weakly binodose). Anterior angles obtusely rounded in dorsal view. Male mandibles cylindrical, 1.5–2× as long as head, externally almost straight until curving internally abruptly before apex. Dentate carina internally on dorsal mar-

gin only in basal half (in basal half variably reduced to 1–2 teeth or low carina), becoming internal in apical half; additional dorsal tooth occasionally present near apex in male majors; apex not hooked upwards, lacking patch of setae. Base of mandibles lacking ventral tooth. Female mandible externally straight, dorsally flattened, with median internal tooth. Galeal brush elongate, 2–3× longer than mentum (except labial palps of females subequal to mentum). Antennal scape with sparse area of long setae present in males. ***Pronotum*:** Posterior and lateral angles dentate, lateral angle more strongly so in males. Lateral margins indistinct, often obsolete anteriorly (occasionally distinct in major males). Dorsal surface nearly evenly convex, not strongly ridged, longitudinal median furrow weak, weak depressions indicated either side of disc before middle in most specimens. Surface with distinct, moderately long setae in females, short setae in depressions and long setae along anterior margin in males. ***Elytra*:** Surface shiny, appearing smooth, actually densely punctate, weakly wrinkled, setose; setae scale-like, microscopic, often abraded; females with scattered longer bristle-like setae as on pronotum, bristles distinct macroscopically. Apex obtusely angulate, lacking spine. Epipleuron strongly concave. ***Legs*:** Protibiae elongate, serrate externally; ventral surface along internal margin with teeth well developed in males, lacking in females. ***Male genitalia*:** Flagellum long, length more than 3× length of parameres and basal piece together (Fig. 4).

Distribution. This species is distributed widely in central Chile (Fig. 29). Chalumeau and Brochier (2007) listed specimens from Lago Chapo and Llanquihue in Región X Los Lagos, but we did not examine any specimens from these localities.

CHILE (51): **Biobío** (7): "Arauco"; **La Araucanía** (44): Cherquenco, Cunco, Curacautín, Las Raíces, Lonquimay, Malalcahuello, Cordillera de Malleco, Manzanar, Nahuelbuta, Victoria; Villarrica. **Los Ríos** (1): "Valdivia". **No data** (2).

Temporal distribution. January (13), February (8), June (3), July (2), October (1), November (7), December (13).

Diagnosis. Males of this species can be distinguished by the shiny pronotum and elytra (Fig. 16) in combination with the apex of the elytron being angulate (not spinose or rounded). Often the lateral margin of the pronotum is obsolete in the apical half, but in larger males the margin may be distinct. The long male protibiae, long flagellum of the male genitalia, and the distinctly visible bristles scattered on the elytra of females (Fig. 17) will easily separate this species from *C. latreillei.*

Remarks. The identity of *C. impubis* is often incorrect in collections, and the species is generally treated as *C. latreillei* by commercial dealers and in Mizunuma and Nagai (2001). Based on examination of the lectotype, Chalumeau and Brochier (2007) correctly determined the identity of this species but placed it in their genus *Bomansodus.* The characters on which the genus are based are not robust, especially the effaced lateral margin of the pronotum, which is not consistently expressed even within the species. Furthermore, the shape of the protibiae, epipleuron, elytral margin, and mandibles of both sexes argue for a close relationship with *C. mniszechii,* and, to a lesser extent, *C. grantii* and *C. jousselinii.* Females of *C. impubis* are the only ones in the genus to have macroscopically visible scattered bristles on the elytra.

Figures 16–17. Dorsal habitus of *C. impubis.* **16** male, and **17** female.

Other species may have scattered bristles, but when present they can only be seen under magnification.

The lectotype was reported from "Chili… Mendoza, on the eastern side of the Cordillera" (Parry 1870), a somewhat nonsensical combination that could correspond to the area east of Volcán Chillán. This area is currently in Chile, but is depicted as being in Mendoza on maps dated slightly earlier (Greenleaf 1840). Ocampo and Paulsen (2008) followed Maes (1992) and listed the species from Argentina. While it is probable that the species occurs in eastern Neuquén Province, we do not know of any recent records of this species from Argentina.

Chiasognathus jousselinii Reiche, 1850

Figs 5, 18, 20, 22, 27

Chiasognathus jousselinii Reiche, 1850: 259, original combination. Type material: holotype male (MNHN) labeled: a) bordered label "Ex-Musæo / Mniszech"; b)

handwritten "*Jousselini* / Reiche"; c) handwritten "*Chiazognathus* / *Jousselini*"; d) "MUSÉUM PARIS / [2810]"; e) red paper, "TYPE"; f) handwritten "*Chiasognathus.* / *jousselini* . Reich. / Det: JP. LACROIX."; g) handwritten "Figure I. 1969 / JP. LACROIX."; h) bordered label "Southern Neotropical Scarabs / database # AS2618225 / *Chiasognathus jousselinii* / Reiche, 1850 [male symbol] / DET: A.B.T. SMITH 2009"; i) red label "*Chiasognathus* / *jousselinii* [male symbol] / Reiche, 1850 / HOLOTYPE / Det. M.J. Paulsen". The holotype was fixed by monotypy when Reiche (1850a, b) explicitly indicated that only one specimen was used to describe this species. Type locality: "versant oriental des Andes du Chili" (Reiche 1850b).

Description. ***Length*:** 22.0–33.9 mm. ***Width*:** 10.0–13.1 mm. ***Color*:** Reddish brown, with weak metallic reflections, appearing lighter from dense covering of light brown, scale-like setae. ***Head*:** Form subquadrate. Surface punctate; punctures fine to coarse, generally setose with short to long setae, especially laterally. Anterior margin of head roundly produced beyond anterior angles and with median nasus; nasus composed of 2 rounded teeth. Anterior angles obtusely rounded in dorsal view. Male mandible (Fig. 20) setose, cylindrical, robust, 2–3× as long as head, weakly rounded externally until abruptly, internally curved at apex; apex curved weakly upward, lacking patch of setae. Dentate carina with 4–10 obtuse teeth; teeth variably reduced, almost obsolete. Base of mandibles without ventral tooth. Galeal brush long, longer than first and second labial palpomeres combined. Antennal scape in males with sparse area of long setae at apex. ***Pronotum*:** Posterior and lateral angles subdentate (angulate in small males). Lateral margins distinct, crenulate. Disc with central area raised and with strong transverse ridge either side of broad median longitudinal depression; depressed areas variably setose, setae moderately long in males (shorter than length of distal antennomere of antennal club), lacking scattered longer setae. ***Elytra*:** Surface rough, slightly wrinkled, generally obscured by dense cover of short scale-like setae. Apex rounded to subdentate, lacking spine; elytral margin thickened, without bead. Epipleuron flat. ***Legs*:** Protibiae elongate, dentate basally with 4–6 small teeth (Fig. 18); ventral surface along internal margin with teeth well developed. ***Male genitalia*:** Flagellum moderately long, longer than length of parameres and basal piece together (Fig. 5). Females unknown.

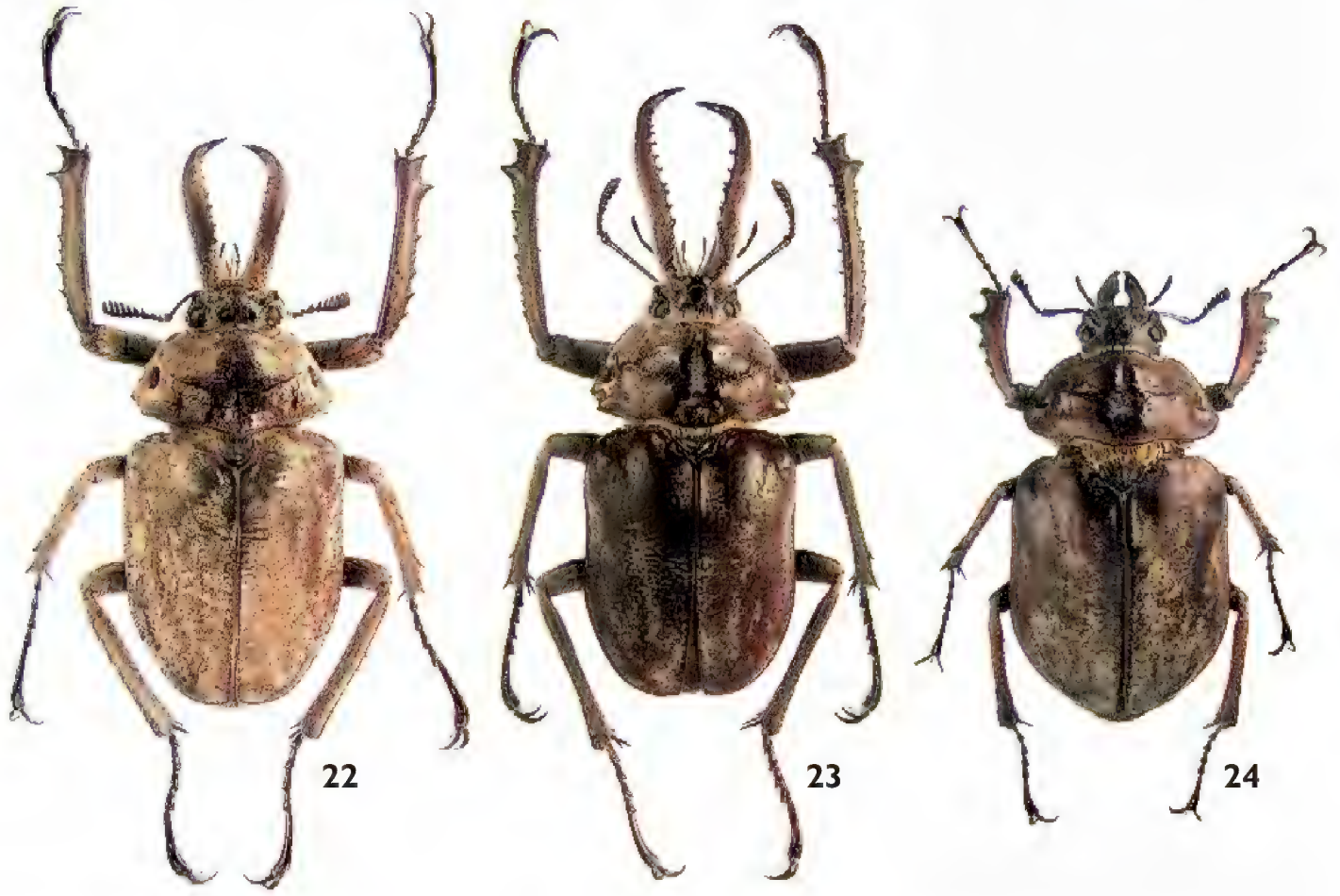
Distribution. Only known from the west side of the Nahuelbuta Cordillera (Fig. 27).

CHILE (9): **Biobío** (5): Cañete, "Concepción". **No data** (4).

Temporal distribution. December (4). No data (5).

Diagnosis. This species can be readily distinguished from the other squamose species, *C. mniszechii,* by the shorter, more robust and less strongly dentate mandibles in males (Fig. 20), dentate rather than serrate protibiae (Fig. 18), flat epipleuron, pronotum lacking long scattered setae, and thickened elytral apices that lack a marginal bead apically. The flagellum of the male genitalia is nearly twice as long in *C. jousselinii* as it is in *C. mniszechii* (Figs 5–6). With only nine male specimens located in collections, the female of this species remains unknown.

Remarks. The fact that the holotype of *C. jousselinii* is clearly not conspecific with the more common *C. mniszechii* was recognized by Lacroix (1979), but this species has otherwise been confused with *C. mniszechii* (Krajcik 2001; Molino-Olmedo 2001, 2002; Chalumeau and Brochier 2007). The two species are easily separated when the appropriate characters are examined. Very few specimens of *C. jousselinii* are known, which has not helped to alleviate the confusion. We were able to study specimens graciously loaned by Alfredo Ugarte Peña that were collected in Cañete, and they



Figures 18–24. 18–19 Right protibia of males. **18** *C. jousselinii,* and **19** *C. mniszechii.* Scale bar = 2mm. **20–21** Right mandibles of males. **20** *C. jousselinii,* and **21** *C. mniszechii.* Scale bar = 5mm. **22–24** Dorsal habitus of *Chiasognathus* species. **22** *C. jousselinii,* male, **23** *C. mniszechii,* male, and **24** *C. mniszechii,* female.

remain the only specimens known with reliable locality information. It is likely that this species is restricted to the western side of the Nahuelbuta Cordillera, where other rarely encountered and potentially threatened stag beetles are also found: *Pycnosiphorus franzae* (Weinreich) and *Hilophyllus penai* (Martínez). Very little of this habitat is currently protected, and it is instead being logged at an alarming rate (Smith-Ramirez 2004). Thus, the future of these three species is in doubt, and their need for conservation should be studied in detail.

***Chiasognathus latreillei* Solier, 1851**

Figs 9, 11, 13, 30

Chiasognathus latreillei Solier, 1851: 42, original combination. Type material: Lectotype female (MNHN) labeled a) green circular label with underside "15 / 43"; b) "MUSEUM PARIS / CHILI / GAY 15–43"; c) red letters "TYPE"; d) handwritten "*Chiasognathus* / ~~*rufipennis*~~ *Latreillei* / Gay-Sol."; e) "MUSÉUM PARIS / [Type. 290D.]"; f) bordered label "Southern Neotropical Scarabs / database # AS2618224 / *Chiasognathus latreillei* / Solier, 1851 [female symbol] / DET: A.B.T. SMITH 2009"; g) red label "*Chiasognathus* / *latreillei* [female symbol] / Solier, 1851 / LECTOTYPE / Det. M.J. Paulsen". Lectotype designated by Chalumeau and Brochier (1995) by inference under ICZN Article 74.6 when they referred to the specimen as the holotype. Solier (1851) gave no definitive indication that there was only one specimen in the type series. Type locality: "Chile."

Chiasognathus imberbis R. Philippi in F. Philippi, 1859: 657. Type material: Lectotype male (MNNC) designated by Chalumeau and Brochier (1995) labeled a) handwritten "261."; b) "CH. [*schönemanni*] male symbol / #2 det. J. Numhauser. VII-1993 / genitalia dissect. J.N."; c) handwritten "*Chiasognathus* / *imberbis* PHIL. / dét. F. Chalumeau / & B. Brochier '94"; d) red paper "LECTOTYPE"; e) "*Chiasognathus latreillei* / Solier / Dét. F. Chalumeau & B. Brochier / ['94]; f) red, bordered label "*Chiasognathus* / *imberbis* / Philippi, 1859 [male symbol] / Lectotype / A.B.T. Smith. Two male paralectotypes (MNNC). Type locality: "Chile."

Chiasognathus reichei Thomson, 1862: 407. Type material: Lectotype male, **HERE DESIGNATED** (MNHN) labeled a) black-bordered "Th. / TYPE"; b) handwritten "Reichei / Type Thoms. / I, 1862 Chile"; c) " Ex-Musæo / JAMES THOMSON"; d) "MUSÉUM PARIS / [291D]; e) handwritten "*Chiasognathus* / *latreillei* Solier / Det: JP. Lacroix"; f) "*Chiasognathus latreillei* / Solier / Dét. F. Chalumeau & B. Brochier ['94]"; g) red label "*Chiasognathus reichei* / Thomson, 1862 [male symbol] / LECTOTYPE / Det. M.J. Paulsen". The length was given as a range in the original description indicating that more than one specimen was used (Thomson 1862), thus the MNHN specimen is considered the lectotype. Type locality: "Chili."

Description. ***Length*:** 16.6–29.9 mm. ***Width*:** 8.4–13.0 mm. ***Color*:** Reddish brown with or without green, blue, or purple metallic reflections. ***Head*:** Form subquadrate.

Surface punctate; punctures fine to coarse, generally setose with short to long setae. Anterior margin of head rounded or concave, not strongly produced beyond anterior angles, with or without median nasus; nasus variable, unidentate or bidentate, frequently migrated below anterior margin of head. Anterior angles obtusely rounded in dorsal view. Male mandibles usually strongly narrowed to apex, 1.5–2× as long as head, externally almost straight until internally curved apex. Dentate carina beginning with basal tooth on dorsal surface, continuing with median teeth becoming internal; dorsal and ventral teeth usually absent either side of apex; apex lacking patch of setae. Base of mandibles with or without ventral tooth. Female mandible elongate, externally almost straight, dorsally flattened, with median internal tooth. Galeal brush short, less than 1.5× as long as mentum. Antennal scape with sparse area of long setae present in males, rarely only 1–2 setae present. ***Pronotum*:** Posterior and lateral angles subdentate or obsolete, rarely distinctly dentate. Lateral margins distinct, crenulate. Dorsal surface generally weakly defined with transverse ridge, broad longitudinal median furrow broad, and depressions indicated either side of disc before middle in most specimens. Surface near margins with distinct, moderately long setae and short bristles, glabrous in some males examined. ***Elytra*:** Surface weakly shiny, appearing wrinkled, densely punctate, setose; setae scale-like, often abraded except on lateral and apical elytral declivities; females lacking scattered longer bristle-like setae. Apex rounded, lacking spine. Epipleuron flat. ***Legs*:** Protibiae short, serrate externally; ventral surface along internal margin with 2–5 small to large teeth. Mesotibiae slender (Fig. 11). ***Male genitalia*:** Flagellum short, shorter than length of basal piece (Fig. 9).

Distribution. Central Chile and adjacent Argentina (Fig. 30).

ARGENTINA (48): **Chubut** (44): El Turbio, Los Alerces; **Neuquén** (3): Huahum, Lago Lolog; **Río Negro** (1): Llao Llao Península.

CHILE (37): **La Araucanía** (12): Caramavida, Cherquenco, Curacautín, Parque Nacional Huerquehue, Malleco, Volcán Llaima; **Los Ríos** (1): Parque Nacional Mocho Choshuenco; **Los Lagos** (22): Correntoso, Cucao, Hornohuinco, Lago Chapo, Llanquihue, Osorno, Parque Nacional Puyehue (Antillanca, Volcán Casa Blanca); **No data** (2).

Temporal distribution. January (9), February (5), April (1), October (43), November (8), December (11). No data (7).

Diagnosis. This species is not easy to characterize externally (Fig. 13) but can be best distinguished by the characters given in the key. The genitalia of all male specimens examined have a short flagellum (Fig. 9).

Remarks. The lectotype of *C. latreillei* is a female, and it is difficult to match with any of the eight females from known localities that are on hand. The male lectotype specimens of *C. imberbis* and *C. reichei* are both similar to more recent specimens from the Lago Chapo/Puyehue area based on mandibular form and overall coloration. However, the disparate dentition of the male mandibles with respect to disjunct localities in the specimens examined indicates this taxon may represent a complex of more than one cryptic species. More specimens from additional localities are necessary to get a better picture of the specific limits. The specimens examined from Llao Llao

Península (CASC), Caramavida (CASC), and Osorno (SMTD) exhibit enough variation to make their association with *C. latreillei* uncertain. Nothing is known about the life history of these beetles.

***Chiasognathus mniszechii* Thomson, 1862**

Figs 6, 19, 21, 23–24, 31

Chiasognathus mniszechii Thomson, 1862: 406, **revised status**. Type material: Lectotype male (MNHN) labeled: a) bordered label "Ex-Musæo / Mniszech"; b) bordered label "*Th.* / TYPE"; c) handwritten "*Mniszechii* / Type Thoms / 4.1862 Chili / [300]"; d) "MUSÉUM PARIS / [280D.]"; e) red paper, "TYPE"; f) "[1993] / *Chiasognathus jousselinii* / Reiche / Det: F. Chalumeau & B. Brochier"; g) handwritten "*Chiasognathus. / jousselini.* Reich. / Det: JP. LACROIX."; h) bordered label "Southern Neotropical Scarabs / database # AS2618226 / *Chiasognathus mniszechii* / Thomson, 1862 [male symbol] / DET: A.B.T. SMITH 2009"; i) red label "*Chiasognathus* / *jousselinii* [male symbol] / Thomson, 1862 / LECTOTYPE / Det. M.J. Paulsen". Lectotype designated by Chalumeau and Brochier (1995) by inference under ICZN Article 74.6 when they referred to the specimen as the holotype. Thomson (1862) gave no definitive indication that there was only one specimen in the type series. Type locality: "Chili."

Chiasognathus schoenemanni Kriesche, 1919: 94, **new synonymy**. Type material: Lectotype male (SMTD) designated by Chalumeau and Brochier (1995) labeled a) handwritten "Chile / Bader von Longavi, / Parral"; b) handwritten "*Chiasognathus / schoenemanni / Cotyp!*"; c) "sammlung KRIESCHE / Ankauf 1974"; d) red label "Typ"; e) "Staatl. Museum für / Tierkunde. Dresden"; f) bordered "[-93] / Chiasognathus / schoenemanni / dés. F. Chalumeau & / B. Brochier"; f) "[-94] / Chiasognathus jousselinii / Reiche / Dét. F. Chalumeau & B. Brochier". g) red label "*Chiasognathus* / *schoenemanni* [male symbol] / Kriesche, 1919 / LECTOTYPE / Det. M.J. Paulsen". Five paralectotype males (ZMHB).Type locality: "Chile, Bäder von Longavi, Parral."

Description. ***Length*:** 22.0–42.2 mm. ***Width*:** 10.7–14.8 mm. ***Color*:** Brown to reddish brown, with weak metallic reflections, appearing gray from dense covering of scale-like setae (Figs 23–24); setae variably abraded or greased. ***Head*:** Form subquadrate. Surface punctate; punctures fine to coarse, generally setose with short to long setae, especially laterally. Anterior margin of head roundly produced beyond anterior angles and with median nasus; nasus variable with two distinct or conjoined teeth or reduced to a single process, in females nasus migrated downward from anterior margin. Anterior angles obtusely rounded in dorsal view. Male mandible (Fig. 21) setose, cylindrical, narrow, 2–3× as long as head, externally sinuate until abruptly, internally curved at apex; apex curved weakly upward, lacking patch of setae. Dentate carina of 15–20 peg-like teeth beginning on dorsal margin in basal third (in basal third teeth

variably reduced to form low carina), becoming internal in median third, but dorsal again in apical third. Base of mandibles with acute ventral tooth; tooth occasionally obsolete. Female mandible as long as head, externally weakly rounded, dorsally flattened, with median internal tooth. Galeal brush short, shorter than first and second labial palpomeres combined. Antennal scape in males with sparse area of long setae at apex. ***Pronotum*:** Posterior and lateral angles obtusely angulate (rarely subdentate), posterior angle more strongly so in males, both angles almost obsolete in females. Lateral margins distinct, crenulate. Dorsal surface with strong transverse ridge either side of triangular median longitudinal furrow, weak depressions indicated either side of disc before middle in most specimens; furrow and depressions variably setose; setae short to long in males (3× longer than length of distal antennomere of club), short in females. ***Elytra*:** Surface rough, slightly wrinkled, generally obscured by dense cover of scale-like setae (especially in males). Apex subdentate, but lacking spine; elytral margin narrow, beaded. Epipleuron strongly concave. ***Legs*:** Protibiae elongate, serrate externally (Fig. 19); ventral surface along internal margin with teeth well developed in males, variably developed in females. ***Male genitalia*:** Flagellum short, shorter than length of parameres and basal piece together (Fig. 6).

Distribution. Central Chile and adjacent Neuquén, Argentina (Fig. 31).

ARGENTINA (2): **Neuquén** (2): Parque Nacional Lanín.

CHILE (60): **Maule** (1): Estero Leiva; **Biobío** (24): Atacalco, Cordillera Chíllan, Las Trancas, Pemehue; **La Araucanía** (35): Cherquenco, Cunco, Curacautín, Las Raíces, Manzanar.

Temporal distribution. January (6), February (32), March (1), December (23).

Diagnosis. This is the most commonly encountered species with dense, velvety pubescence on the elytra of males. If the scales are abraded, males of this species can still be recognized because they have narrower, more sinuate mandibles than the other species in the genus (Fig. 21). In addition, *C. mniszechii* differs from the other densely scaled species, *C. jousselinii,* in having the basal part of the protibiae serrate instead of dentate (Fig. 19), strongly concave epipleura, and a marginal bead on a narrow elytral margin apically.

Remarks. This species is one of the more commonly collected and widespread species in the genus, and it has been collected at mercury vapor lights. Because the species has for so long been incorrectly synonymized under *C. jousselinii,* all distributional records or information previously published for *C. jousselinii* (*e.g.,* Benesh 1960; Ocampo and Paulsen 2008) is likely to apply instead to *C. mniszechii*.

Chiasognathus sombrus Paulsen & Smith, sp. n.

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Figs 7, 10, 25–26, 32

Type Material. Holotype male deposited at MNNC, labeled a) "CHILE: ÑUBLE PROV. / El Marchant / 26-XI-2004 / leg. Sergio Ocares"; b) red label "*Chiasognathus* /

sombrus (male symbol) / Paulsen & Smith / HOLOTYPE." Allotype female deposited at MNNC, labeled a) "CHILE: REGÍON BIO-BIO / Prov. Ñuble, El Marchant / 15-XI-2006 / leg. Sergio Ocares"; b) red label "*Chiasognathus* / *sombrus* (female symbol) / Paulsen & Smith / ALLOTYPE." Two male paratypes (MNNC) same data as holotype. One male paratype (MNNC) labeled a) "Cord. Chillan / Las Trancas / 12.90 / coll. G. Moreno"; b) "*Chiasognathus latreillei* / Solier / Dét. F. Chalumeau & B. Brochier / ['95]". Ten male, two female paratypes (JMEC, MJPC, UNSM) same data as allotype. Eleven male, three female paratypes (JMEC, MJPC, EPGC) labeled "CHILE, Región del Biobío, Las Trancas, 18-X-1998, leg. S. Ocares". Eight male paratypes (JMEC, MJPC, EPGC, BMNH) labeled "CHILE, Región del Biobío, El Marchant, 20-X-2006, leg. S. Ocares". Four male paratypes (JMEC) labeled "CHILE, Región del Biobío, El Marchant, 26-XI-2004, leg. S. Ocares." One female paratype (JMEC) labeled "Chile, Región del Biobío, Ñuble, Los Lleuques, 13/10/2006, leg. S. Ocares". Four male paratypes (MJPC) labeled "CHILE REGIÓN BIO-BIO / Prov. Ñuble, Atacalco / 12-X-2005 / leg. S. Ocares". One male paratype (MJPC) labeled a) "CHILE: Biobio / Chillan; X.2006"; b) orange label "DNA VOUCHER / P67 2009 / MJ PAULSEN – UNSM". One male paratype (LBC) labeled "CHILE – BIO BIO / OCTOBER 2004 / LEG. THOMSON". Six male paratypes (AUPC, ABTS) labeled "Las Trancas / Chillan / Enero- 1992 / leg. S. Figueroa". One male, three female paratypes (AUPC, ABTS) labeled "Las Trancas, / Chillan . XI-90". One female paratype (AUPC) labeled "Andes, Ñuble / CHILE, Dec. 91". One female paratype (CASC) labeled "CHILE / Nubles / Nov. 91". Two male paratypes (SMTD) labeled a) "CHILI / NUBLE, CHILLAN / NOV. 1993 / LEG. PENA"; b) "*Chiasognathus beneshi* / Lacroix / Dét. F. Chalumeau & B. Brochier / ['95]". One male paratype (SMTD) labeled as previous except "Dec. 1991". One male paratype (SMTD) labeled "CHILE / Nubles / Nov. 91". One male paratype (CMNC) labeled "CHILE: REGIÓN VIII (BIOBÍO) / Ñuble Prov., Atacalco / 20 October 2005, S. Ocares".

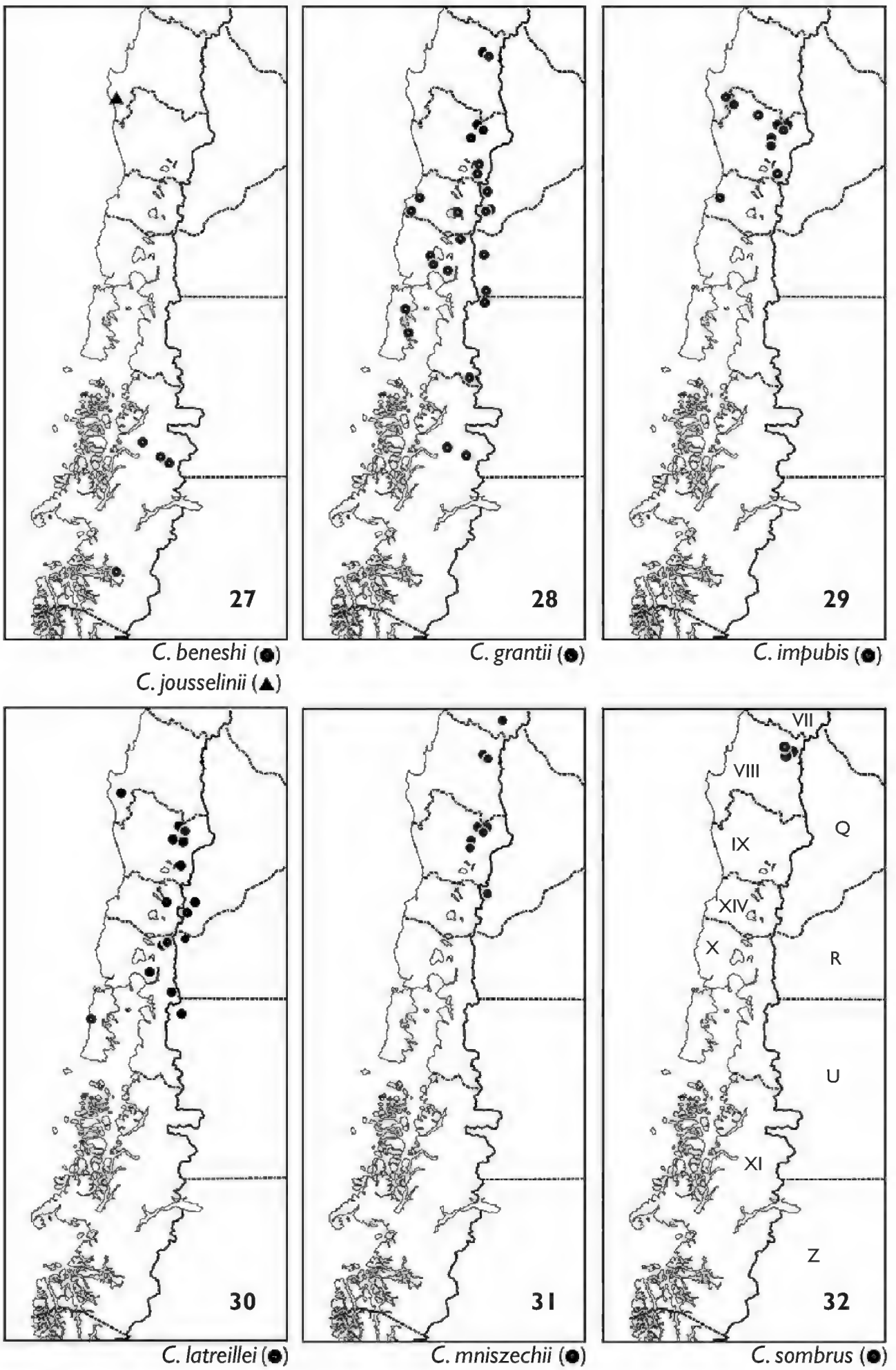
Description, holotype male (Fig. 25). ***Length*:** 30.7 mm. ***Width*:** 13.5 mm. ***Color*:** Dark reddish brown, pronotum with gold metallic reflections on disc, reflections becoming purple laterally and blue at margin; scutellum with greenish blue and purple metallic reflection; elytra with disc greenish brown due to weak green and purple metallic reflections, lateral margin with darker green reflection; head, mandibles at base, venter, and legs with green metallic reflection except tarsi, distal third of tibiae, and entire ventral surface of protibiae lacking metallic reflection. ***Head*:** Form almost semicircular. Surface punctate; punctures fine to coarse, some punctures with short setae. Anterior margin of head rounded, produced beyond rounded anterior angles, lacking median nasus. Mandibles almost 2× as long as head, externally rounded, robust (not flattened in lateral view); dentate carina on dorsal margin only in basal third, then continuing on internal face to below apex; teeth of carina variable along mandible with large basal tooth, large tooth in basal third, and 5 more or less conjoined teeth in apical half. Apex curved inwards, distally acute and hooked upwards, lacking patch of setae inside apex. Base of mandibles lacking ventral tooth. Galeal brush elongate, 2–3× longer than mentum. Scape without well-developed area of long setae. Right antennal club missing. ***Pronotum*:** Posterior angle strongly dentate, acute; lateral angle almost obsolete. Lateral margins distinct, weakly

crenulate. Dorsal surface with weak transverse ridge medially and distinct longitudinal median depression. Lateral fovea distinct, circular, impunctate. ***Elytra*:** Surface appearing rough macroscopically, not shiny, wrinkled on disc, punctate, setose; setae of 2 types: scattered bristle-like, erect setae and flattened, scale-like setae, scale-like setae apparently abraded except in rugae. Apex rounded. Epipleuron flat. ***Legs*:** Protibiae not elongate, dentate externally; ventral surface along internal margin with teeth weakly developed. Mesotibia thickened and appearing bent outwards at large external tooth (Fig. 10).

Description, allotype female (Fig. 26). ***Length*:** 28.1 mm. ***Width*:** 13.4 mm. Differs from holotype male in the following characters. ***Color*:** Metallic reflection dorsally muted except on scutellum at base. ***Head*:** Mandibles triangular with flat dorsal surface, densely punctate, with single internal tooth at distal third and internal margin blade-like in distal third. ***Pronotum*:** Posterior angles lacking tooth, lateral angles prominent.

Description, variation in paratype males. ***Length*:** 23.1–31.2 mm. ***Width*:** 11.4–13.3 mm. Differ from holotype male in the following characters. ***Head*:** Rounded anterior margin of head occasionally appearing weakly binodose. Mandibles with dorsal surface proximal to apex with additional weak tooth. ***Pronotum*:** Lateral angle variably developed from almost obsolete to distinct. ***Male genitalia*:** Flagellum moderately long, subequal in length to parameres and basal piece together (Fig. 7).

Figures 25–26. Dorsal habitus of *C. sombrus,* sp. n. **25** holotype male, and **26** allotype female. Scale bar = 5mm.



Figures 27–32. Distribution of *Chiasognathus* species. Regions of Chile and Provinces of Argentina indicated on Figure 32 as follows: VII Maule, VIII Biobío, IX La Araucanía, X Los Lagos, XI Aisén, XIV Los Ríos, Q Neuquén, R Rio Negro, U Chubut, Z Santa Cruz. All localities indicated with circles except for *C. jousselinii* (triangle). **27** *C. beneshi, C. jousselinii* **28** *C. grantii* **29** *C. impubis* **30** *C. latreillei* **31** *C. mniszechii,* and **32** *C. sombrus.*

Description, variation in paratype females. ***Length*****:** 22.6–30.0 mm. ***Width*****:** 11.8–15.7 mm. Female paratypes do not differ significantly from the allotype.

Distribution. The species is only known from Ñuble Province, VIII Región del Biobío, Chile (Fig. 32).

CHILE (66): **Biobío** (66): Atacalco, "Chillán", El Marchant, Las Trancas, Los Lleuques, "Ñuble".

Temporal distribution. October (29), November (28), December (2), January (6).

Diagnosis. This species is distinguished by its darker coloration, thickened and bent mesotibiae, and long galeal brush in both sexes. The scattered elytral bristles, although not distinct macroscopically, are more prominent in this species than in all others except *C. impubis.*

Remarks. This species was mistakenly treated as *C. beneshi* in Mizunuma and Nagai (2001) and Chalumeau and Brochier (2007). It has been referred to as *C. schoenemanni* in collections and by commercial dealers; however, examination of the holotype of *C. schoenemanni* revealed that name to be a synonym of *C. mniszechii.*

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